

the cited references fail to disclose each and every element of Applicants' amended claim 1. M.P.E.P. § 2131.

Applicants' invention as recited in amended claim 1 is directed to a plasma etching method for implementing a specific etching process on a workpiece placed on an electrode provided within a processing chamber by introducing a processing gas into the processing chamber, generating plasma inside the processing chamber with a plasma source, and applying biasing power to the electrode. The method further includes an etching step in which the workpiece is etched over a specific length of etching time by applying the biasing power to the electrode and a film formation step in which a protective film is formed as an etching mask at a surface of the workpiece over a specific length of film formation time while the biasing power is decreased or cut off are sequentially repeated, with the lengths of individual etching times and individual film formation times adjusted to be increased relative to the length of etching time as the etching process progresses.

In contrast, the Okudaira et al. reference discloses an etching process in which etching and deposition gases are alternately introduced into a vacuum container. Col. 5, lines 38-40. A microwave generating power supply is periodically turned on and off, whereby plasma is periodically generated as the gas is excited by the microwaves. Col. 5, lines 45-48. Periodic gas switching and application of high frequency bias power (RF power) is conducted according to a time schedule. Col. 6, lines 18-20. The alternation between the etching gas and the deposition gas introduction is performed with a constant period of 3 seconds for the etching gas and constant period of 10 seconds for the deposition gas, and the RF power is intermittently applied for a constant

period of 1.2 seconds. (See, e.g., Fig. 3, which shows constant intermittent alternating time periods for introduction of each of the etching gas and the deposition gas, and the constant intermittent application of the RF power supply.)

Therefore, the Okudaira et al. reference does not disclose or suggest at least a plasma etching method including an etching step in which the workpiece is etched over a specific length of etching time by applying the biasing power to the electrode and a film formation step in which a protective film is formed as an etching mask at a surface of the workpiece over a specific length of film formation time while the biasing power is decreased or cut off are sequentially repeated, with the lengths of individual etching times and individual film formation times adjusted to be increased relative to the length of etching time as the etching process progresses. Therefore, the Okudaira et al. reference does not disclose or suggest at least that subject matter recited in amended claim 1.

Like the Okudaira et al. reference, the Collins et al. reference does not disclose or suggest Applicants' invention as recited in amended claim 1. The Collins et al. reference discloses etching a layer of material, such as an oxide, overlying a non-oxygen containing material, such as silicon. Col. 6, lines 47-50. The process disclosed in Collins et al. includes cyclically driving a bias voltage to a low value to form an etch suppressing layer, such as a polymer, on the silicon and a high value voltage to etch the second material at a high rate relative to substrate. Col. 6, lines 52-57. In one process disclosed in Collins et al., a high baseline DC bias voltage is periodically pulsed or modulated to a low value. Col. 16, lines 25-29. The low value voltage is at or below a cross-over voltage, between silicon etching and silicon deposition, yet at or above the

oxide cross-over voltage. Col. 16, lines 29-32. The low voltage is characterized by deposition on a polysilicon layer, but at least slight etching of an oxide. Col. 16, lines 37-38. The pulse width of the low voltage is about 0.1 second and the pulse width of the combined low voltage and high voltage is about 1 second. Col. 16., lines 41-44.

Like the Okudaira et al. reference, however, the Collins et al. reference does not disclose or suggest at least a plasma etching method including an etching step in which the workpiece is etched over a specific length of etching time by applying the biasing power to the electrode and a film formation step in which a protective film is formed as an etching mask at a surface of the workpiece over a specific length of film formation time while the biasing power is decreased or cut off are sequentially repeated, with the lengths of individual etching times and individual film formation times adjusted to be increased relative to the length of etching time as the etching process progresses. Therefore, the Collins et al. reference does not disclose or suggest at least that subject matter recited in amended claim 1.

Furthermore, the other cited reference, Lantsman (U.S. Pat No. 5,573,597) fails to overcome the deficiencies of the Okudaira et al. and Collins et al. references.

Accordingly, Applicants submit that amended independent claim 1 is allowable. Furthermore, Applicants submit that claims 2-6 and 12 are allowable by virtue of their dependency on claim 1 as well by their additional recitations of novel and non-obvious subject matter. Therefore claims 1-6 and 12 should be allowable.

Applicants respectfully request the reconsideration and reexamination of this application and the timely allowance of the pending claims.

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If the Examiner believes that a telephone conversation might advance prosecution, the Examiner is cordially invited to call Applicants' representative at 571-203-2739.

Applicants respectfully submit that the Office Action contains numerous assertions relating to the related art and the claims. Regardless of whether those assertions are addressed specifically herein, Applicants decline to automatically subscribe to them.

Please grant any extensions of time required to enter this response and charge any additional required fees to our Deposit Account No. 06-0916.

Respectfully submitted,

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By: 

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APPENDIX TO THE AMENDMENT

IN THE CLAIMS:

Please cancel claims 7-11 without prejudice or disclaimer, amend claim 1, and add new claim 12, as follows:

1. (Amended) A plasma etching method for implementing a specific etching process on a workpiece placed on an electrode provided within a processing chamber by introducing a processing gas into said processing chamber, generating plasma inside said processing chamber with a plasma source and applying biasing power to said electrode, wherein;

an etching step in which the workpiece is etched over a specific length of etching time by applying the biasing power to said electrode and a film formation step in which a protective film is formed as an etching mask at a surface of the workpiece over a specific length of film formation time while the biasing power is decreased or cut off are sequentially repeated, with the lengths of individual etching times and individual film formation times adjusted to be increased relative to the length of etching time as the etching process progresses.

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